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THE EFFECTS OF ETHNICITY ON EVACUATION DECISION-MAKING*

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This paper develops a single stage theoretical model that examines the impact of citizen ethnicity on evacuation warning compliance. Three ethnic groups are examined: blacks, whites, and Mexican-Americans. Other independent variables in the model include risk perception, possession of an adaptive plan, warning content, warning confirmation, income, and warning source credibility. The model is tested on data from a flood and a hazardous materials incident. In both events, it was found that respondent ethnicity and income had small and statistically nonsignificant effects upon warning compliance. Perceived risk was the best predictor of compliance in each data set. Ethnic group differences were detected in terms of the specific sources identified as most credible and in terms of the first source contacted for warning confirmation.

Citizen response to disaster warnings is frequently touted as one of the "best studied" aspects of human behavior in disasters. In spite of this designation, there remain many gaps on the empirical record of warning behaviors. Perhaps one of the largest gaps deals with variations in warning behavior by ethnicity (cf. Perry 1987). If one dates modern disaster research from Samuel Prince's (1920) dissertation on the Halifax disaster, then in more than seventy years we have accumulated an extremely small quantity of empirical data on minority citizen disaster behavior. While there have

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been a handful of studies that have addressed the question of ethnicity, the range of phenomena examined and the number of ethnic groups considered have been limited (Drabek 1986, p. 89).

The purpose of this paper is to examine ethnic differences in one particular type of warning response situation: a setting where citizens have been warned to evacuate an endangered area. Two data sets representing different types of disaster events—a flood in Abilene, Texas and a hazardous materials incident in Mt. Vernon, Washington—are used in an effort to obtain a cross-hazard perspective. We will first develop a simple model of evacuation compliance behavior, and then test the model on the data from Mt. Vernon and Abilene. We will also briefly examine the role of ethnicity in other aspects of the evacuation warning setting, including confirmation behavior, sources of warning information and attributions of source credibility.

AN APPROACH TO MODEL CONSTRUCTION

Recently, Drabek (1986, p. 418) has called attention to the paucity of models of disaster phenomena and pointed out that family evacuation behavior seemed to be a prime candidate for modeling. Our interest here is in the creation of a theoretical model; one that seeks to duplicate systems of relationships among concepts (based upon definitions and linking statements) that are specified by some theory-based logic (cf. Hartman 1988, p. 143). Our model will take the familiar causal model form, although the strategy for constructing the model will draw upon recent critiques of modeling practice (Duncan 1984).

Lieberson (1986) has argued that causal modelers have not given appropriate attention to parsimony; identifying the smallest number of concepts that should possess the greatest explanatory power relative to the phenomenon under study. Blalock (1989, p. 457) suggests that modeling as a theoretical process is facilitated if one begins with such a simple model, tests it carefully and expands it gradually to explain more complex phenomena. There are two important points that should not be lost here. First, it is possible to develop a simple model of a complex social process. Second, a special value of simple models is that "...they help us clarify our thinking and enable us to extract implications from admittedly oversimplified versions of reality" (Blalock 1989, p. 457).

Acknowledging the utility of simple models, we interpret simple to mean that one creates a model composed of the smallest number of stages and concepts necessary to understand a given phenomenon. Thus, the model itself depends upon a selection process that is part theoretical; dependent upon the modelers ability to identify key causes. Lieberson (1986, p. 186) reasons that it is in this identification process (called specification) that problems first arise in constructing models:

> A complicated network of causal relations will also appear, but these are largely superficial causes that do not have any impact on the dependent variable, which is actually affected by a very small number of basic causes.

For Lieberson, models should be composed of "basic" rather than "surface" causes. While this idea has much intuitive appeal, Lieberson admits that there is no clear technique for identifying or distinguishing basic and surface causes. Ultimately, the distinction may be abstract or theoretical in itself; identifying basic causes seems inherently embedded in the assumptions and linking logics of theoretical imagery. Indeed, basic causes may be transitory in that as theoretical logic changes, there may also be changes in which concepts constitute basic causes.

A theoretical model is created to assist in the understanding of some social phenomenon. The propositions that compose models constitute a descriptive tool, and when deductions are made models form the basis for explanation and prediction. As our image of the phenomenon-to-be-explained becomes more clear and precise, a model can become more parsimonious and accurate in its ability to describe, explain and predict. Note too that the process of developing a model is ongoing; as new models clarify the phenomenon under study and form the basis for theoretical insights, the model itself requires revision. As a theoretical structure, a model is an ever-changing edifice.

In constructing an evacuation decision-making model, we will attempt to work within the guidelines derived above. We acknowledge that modeling is an ongoing process; consequently our conceptualization process involves use of previous evacuation and related models, as well as having an abstract theoretical component. To achieve structural parsimony, we will develop a single stage model that focuses upon a small number of theoretically and empirically important concepts.

AN EVACUATION DECISION-MAKING MODEL

Our primary modeling goal is to understand what factors are important when a citizen, warned to evacuate a dangerous place, decides whether or to what degree to comply with that warning. It is important to note that interest here is with a specific case of the general disaster warning problem. The setting is such that a warning of danger has been issued prior to impact, and the particular instruction to evacuate has been communicated.

We have previously used the basic tenets of emergent norm theory (Perry et al. 1981) to structure the evacuation warning problem. Thus, we start with three fundamental assumptions about human disaster behavior: (1) people will evaluate threat-relevant messages, (2) the evaluation process involves looking to other people, and (3) when people believe they are faced with danger they will protect themselves. Note that beginning with a minimum set of assumptions is consistent with Lieberson's concern with creating parsimonious models. It also fits the substance of the decision context, regarding which Quarantelli (1980, pp. 87-88) has warned:

> ...that a focus on decision making may imply a more conscious and deliberate act than might often be the case. Decisions to evacuate may actually be less a weighing of alternatives and deciding, than the development of an informal consensus or implicit understanding about what should be done.

This suggests that at least in the case of a decision to evacuate, elaborate models which purport to simulate generalized reasoning processes may to some extent represent misplaced precision.

Our theoretical framework suggests that the message evaluation problem can be addressed within the parameters of three questions. The first question addresses the issue of accuracy and importance of the warning message itself. The issue to be resolved is whether or not the message deserves attention. Thinking conceptually, one can deal with this question in terms of what have been called "warning source confidence" and "warning confirmation." That is, messages worth attention would come from sources initially believed to be trustworthy and could be independently confirmed with other sources.

The second question of interest deals with the individual's perception of situational personal danger. Namely, if the threat described in the

exposed to certain harm? Conceptually, we are introducing the idea of "perceived personal risk," where risk is used globally to refer to risks to person and/or property. It is interesting to note that risk has been shown empirically to be very important in evacuation compliance, and in the adoption of protective measures generally (cf. Drabek 1986, pp. 321-323). Although not well examined empirically, it has also been hypothesized that citizens may respond differently (and more conservatively in compliance terms) when risks involved deal with dangers to person rather than dangers to property (cf. Perry and Lindell 1990, p. 167).

Finally, the third question suggested by our theoretical framework focuses on the person's perception of what can be done to reduce the likely negative consequences. The individual is faced with determining what actions can be undertaken to achieve some degree of protection from the environmental threat described in the warning message. Information pertinent to this question can be conceived as coming from two sources. One place where protective information might be found is in the warning message itself; for years it has been known that effective warnings at least describe the danger, estimate when impact will come and suggest an appropriate protective action. Hence, the degree of specificity of warning content could be expected to provide some protective information. In a different fashion, the possession of a family adaptive (or emergency) plan also enhances the protective information available to an individual. Conceptually, one would reason that time spent in creating a family plan (in advance of some catastrophe) would demand reflection on a variety of protective options. This information could be recalled during an emergency and would provide cues regarding both the kinds of protective actions that might be helpful and perhaps even the logistics of undertaking such actions.

The emergent norm approach directs our attention toward attempting to understand the individual's "definition of the situation" as a function of being confronted with a disaster warning. We contend that much of the information needed to arrive at a definition is assembled in the form of the three questions presented above. Furthermore, our attention is directed toward five concepts that appear to be related to the problem of situational definition: warning confirmation, warning source credibility, warning content, perceived personal risk and adaptive planning. To this collection of concepts, a sixth should be included on empirical grounds: family context. That is, research over decades has consistently shown that citizens tend not

to comply with evacuation warnings unless the safety of family members is known. These concepts—or the indicators (variables) that represent them—will constitute the structure of our evacuation compliance model. With the exception of family context, the inclusion of the various concepts in the model has been justified on theoretical grounds. We will now briefly review the literature on the relationship between each concept and evacuation compliance as a means of insuring that there is an empirical justification for the proposed relationships. We will also report our operationalizations of each concept.

Family context is used to refer to the notion that family members are safely accounted for at the time of warning receipt. A long record of research indicates that families tend to evacuate as units—usually household units (cf. Killian 1952; Quarantelli 1960; Drabek and Boggs 1968). When one or more family members is missing with safety unaccounted for, families tend to organize efforts to obtain information on those missing before complying with evacuation warnings. In most such cases, the family will remain at home, sometimes making inquiries, until the safety of the missing member is known. Interestingly, during the bombing of London during World War II, families were separated by policy sending some women and children to safety outside the city while men remained. In this case, separated families tended to reunite themselves (usually through a return to London) to face danger together (cf. Titmuss 1950). There is a very strong tendency for families to deal with major disasters as a unit. Thus, our model contains the proposition that unless family members are accounted for, citizens will not comply with an evacuation warning. We have not offered an operationalization for family context because in both data sets used here, none of the warning recipients reported that any family members were away from home or otherwise unaccounted for at the time of warning. Thus, family context becomes a constant—rather than a variable—in the data sets and must be removed from the analysis. It remains theoretically important, however, and is consequently retained in the general model itself.

The possession of an adaptive plan captures the extent that the individual has reflected on the problem of community disasters and formulated specific tactics for facing such events. Interest is in planning that took place outside the context of a particular disaster event. The expectation is that such planning anticipates threats, identifies possible protections and leads the individual to think about the details of implementing protections. In this

sense one would expect that adaptive planning would not only influence response behaviors, but also mitigation and preparedness behaviors (cf. Perry and Lindell 1990). A variety of empirical studies have found that adaptive planning is positively correlated with evacuation in threats such as hurricanes (Leonard 1973; Windham et al. 1977, p. 15), floods (Perry et al. 1981, pp. 40-43), and volcanic eruptions (Perry et al. 1980).

In light of this empirical support, it is appropriate to add a second proposition to the model stating that the more precise the adaptive plan, the greater the likelihood of evacuation warning compliance. In constructing an evacuation model, we are primarily interested in evacuation planning as a particular dimension of adaptive planning. Precision, in this context, refers to the inclusion of two types of detail in the plan: concern with a route of egress and a destination. Adaptive planning was here operationalized as five ordinal categories. These were anchored by the claim of "no planning," followed by "a general plan," "knowledge of route only," "knowledge of destination only," and finally "knowledge of both route and destination."

The importance of personal risk in warning compliance generally and evacuation compliance in particular has been reported consistently since the first NORC studies of disaster response (cf. Fritz and Marks 1954). Reviews of empirical studies (Perry 1985, pp. 78-80; Drabek 1986, p. 71) reveal considerable support for the notion that evacuation compliance is greatly enhanced if the warning recipient believes that the threatened disaster event will result in direct and personal harm. Indeed a comparative study of four flood-threatened communities found that at each site perceived personal risk was the strongest predictor of evacuation compliance (Perry et al. 1981). Feeling endangered appears to be an important—if not principal—factor in citizen decisions to adopt any sort of protective action, but particularly in evacuation compliance. It is likely that this contention fits across a variety of hazards, although empirical tests beyond natural disasters have been relatively limited (cf. Lindell and Perry, in press; Slovic et al. 1980).

The third proposition for our model claims that the higher the level of perceived personal risk, the greater the likelihood of evacuation compliance. In operationalizing personal risk, we have focused on two important dimensions of the concept: the idea that impact is certain and the magnitude of likely damage. Thus, personal risk is measured as a four category ordinal scale where citizens were asked to classify themselves as "in no danger,"

"likely to experience slight damage," "likely to experience moderate damage," or "likely to experience severe damage."

Warning confirmation refers to the ability of the warning recipient to confirm the elements of a disaster warning with some source. We have long known that the most common reaction to warning receipt is disbelief (cf. Drabek 1969). It has also been well documented that, perhaps as a function of this initial reaction, citizens commonly begin an information-seeking process following a disaster warning (Drabek and Stephenson 1971; Mileti 1974; Mileti et al. 1975). In emergent norm terms this information-seeking behavior is conceptualized as "milling." The information seeking may involve a simple survey of the environment, contacting friends, neighbors or relatives (by phone or in person), contacting mass media, or contacting some authority (cf. Perry et al. 1981). It is not unusual for warning recipients to contact a number of potential sources, especially when sufficient lead time is present before impact. While the presence of the confirmation process has been often detected, it is not entirely clear what stops confirmation behavior (Perry 1985). Some citizens say that when they are warned by or when they confirm with a source whom they believe to be unimpeachable, they stop seeking more information and act. Others say they look for consistency of information between a couple of sources before ceasing confirmation behavior.

The theoretical importance of warning confirmation stems from at least two dimensions of the concept. One is the interactive/interpersonal dimension. That is, emergent norm thinking emphasizes that the development of a definition of the situation is a collective endeavor; individuals seek contact with authority figures, social networks and kin networks in the process of deciding how to interpret environmental cues. Another dimension is informational. Relative to an initial message, each confirmational contact may know nothing, replicate, add new content, or contradict. Though there is probably some personal rationale for which sources one contacts and in what order, it is not crucial to the use of the concept to define this rationale. Ultimately, interest is in the warning recipient's perception of the collective meaning of all the confirmation contacts that we wish to capture in measuring warning confirmation.

The proposition to be included in our model states that warning recipients who successfully confirm a message are more likely to comply with an evacuation warning. In developing a dichotomous operationalization of

confirmation, warning recipients were asked to reflect on all of their attempted contacts. Three general outcomes were classified as successful confirmation: people who said that they believed their contacts confirmed the original warning message; people who said on balance they had verified the original message and obtained additional information; and people who said they were originally warned by the source they thought most important for confirmation contact. All others were classified as failing to confirm the warning. Such failures included those who did not seek confirmation in the first place, those who were unable to successfully contact additional sources, those whose contacts claimed no knowledge, and those whose contacts refused to cooperate.

Warning content has long been known to be related to a variety of warning responses, particularly evacuation (Fritz and Williams 1957, pp. 15-19). Much attention has been devoted to defining the desirable or optimal content of disaster warning messages; essentially concluding that they should contain basic decision information such as the likely timing and magnitude of the event, location of the impact area, and concrete suggestions about what actions would be protective (cf. Williams 1957, pp. 15-19; Drabek and Boggs 1968, pp. 445-447; Mogil and Groper 1977; Perry et al. 1981, p. 96). In light of existing research, one may propose a fifth proposition which acknowledges that the more specific the warning content, the greater the likelihood of evacuation compliance.

Warning content can be operationalized as a series of ordinal categories representing increasing message specificity. In the case of an evacuation warning, we are concerned with specificity in two senses: the relationship of the person warned to the anticipated place of impact and evacuation as a protective measure. Thus, we used four categories of warning content, beginning with a message that a disaster was imminent, then a message that impact was imminent and probably dangerous, then a message that impact would occur at a specific place and was definitely dangerous, and finally the most specific message that impact would occur at a particular place and that evacuation was necessary.

Finally, when a citizen receives a warning message from a source that is perceived to be credible—that is, trustworthy and reliable—the likelihood of evacuation compliance is increased (cf. Perry 1985, pp. 44-47). We will treat this proposition as the sixth and final one for the evacuation compliance model. In this context, credibility deals with the issue of quality of warning

information rather than the specific content itself. Thus warnings from credible sources lead recipients to be more confident in the accuracy and completeness of the message, the timely nature of the message, and the appropriateness of suggested protective measures. Relative to the emergent norm approach, messages from credible sources demand attention and serious evaluation.

Credibility of sources was operationalized as a series of five ordinal categories. Respondents were asked to classify sources in terms of the extent to which they were reliable and trustworthy. The categories ranged from "often not" reliable and trustworthy, through "sometimes not," "usually reliable and trustworthy," "almost always" to "highly" reliable and trustworthy.

DATA SETS

We have elaborated a single stage model of evacuation compliance using five predictors: perceived risk, warning content, warning confirmation, source credibility and possession of an adaptive plan. The dependent variable in this model is evacuation compliance. We have chosen to operationalize this concept as a series of ordinal categories. The ordinality of the categories comes from increasing approximations of the target protective action: evacuation. Thus our scale ranges through five categories: the respondent "did nothing"; "raised awareness to the environment, but took no action"; undertook either a protective action to "person or to property"; "made preparations to evacuate but did not actually leave"; "evacuated."

Two dimensions, in addition to the independent variables discussed up to this point, will be considered in our empirical examination of the model. The first is that it will be tested on two different disaster events: a flood and a train derailment involving hazardous materials. The second dimension involves testing ethnicity as a factor in evacuation compliance.

Our theoretical model focuses upon understanding what factors are important in citizen decisions to comply with an evacuation warning. It has long been argued that we need to adopt a comparative perspective in devising and testing theories and models of warning response behavior. Both Quarantelli (1982) and Drabek (1989, p. 329) have argued that we should develop a comparative base not only across event (disaster) types but across cultures as well. With regard to evacuation warning compliance,

it is of primary importance to compare events wherein a preimpact warning message was issued and received by citizens. Once this common characteristic is established, we can then define and classify variations that may come from events themselves in terms of the relevant dimensions of a typology of disaster events (cf. Perry 1985, p. 14). Thus, one explains the behavior of individuals in terms of the variables in our model and qualifies those explanations in terms of the characteristics of the disaster event.

Kreps (1989, p. 223) has proposed that a basic typology for disaster events should include the dimensions of length of forewarning, as well as magnitude, scope and duration of impact. In our analysis we will focus on two of these dimensions for interpretative purposes. In any evacuation study, variations between events in the length of forewarning are important; particularly since our emergent norm framework is based on information exchanges the nature of which would be affected by time. The second Kreps' dimension with which we are concerned is scope of the event. For the sake of comparability, one should deal with events of similar scope; in this case the scope of each event of interest is such that it affects a large segment of the community. The remaining two dimensions—event magnitude and duration—are issues that are assessable only after impact. Since our concern with evacuation is with decisions and behaviors that occur before impact, they are not addressed here. One final typological issue, primarily social psychological in nature, will be included in our comparisons, however. Drabek (1986) has proposed that in the context of any disaster warning, one should take into account citizen **familiarity** with the disaster agent. Especially in terms of our emergent norm approach, familiarity may indeed be expected to affect the way citizens define situational danger and the need for information seeking.

Finally, we will include ethnicity explicitly (as a dummy variable) in the evacuation compliance model. In the Abilene flood, both blacks and Mexican-Americans were present in our sample. The Mt. Vernon hazardous materials incident involved Mexican-Americans in the evacuation warning. It is important to note that in terms of our model, ethnicity should **not** have a statistically significant effect on evacuation compliance. That is, without regard to ethnicity, we would expect that the proposition in the model would hold for any American who received an evacuation warning. Thus, people warned by a credible source, who have an adaptive plan, received a specific message, were able to confirm the message and believed risk to be high

should evacuate without regard to whether they are white, black or Mexican-American. Because ethnicity is usually correlated with income, we will add that variable—operationalized as census categories—to the model. This is done simply to check on the relationship between being a minority and income; there is no compelling theoretical logic that allows one to connect income with evacuation compliance behavior.

Two qualifiers should be emphasized though. First, it is likely that differences do exist among ethnic groups regarding **which** sources are credible, **which** sources should be contacted for confirmation, and **how** personal risk is calculated. Second, we assume that all respondents received a warning message, without assessing whether the probability of hearing a message (being included in the warning net) varies by ethnicity.

Within these parameters and assumptions, we will test our model on two data sets. The flood data represent an event that took place in Abilene, Texas. The genesis of the flood threat was the overflow of two creeks following heavy rain, which resulted in the inundation of a low-lying segment of the community. Authorities had ample time to formulate and deliver a warning to evacuate, and post-warning, citizens had approximately three hours before impact. Flooding in Abilene tends to be seasonal, therefore constituting a relatively familiar event both for citizens and authorities.

The train derailment occurred in Mt. Vernon, Washington. It arose when a switching accident knocked a tank car carrying 25 thousand gallons of propane off the tracks near downtown. Although no breech of containment was immediately visible, local authorities determined that threat was sufficient to demand evacuation of the downtown area, including a contiguous residential area. Initially, the evacuation was to be enforced until the arrival of a hazardous materials response team and the replacement of the car on the tracks. The evacuation warning issued advised citizens to evacuate immediately. This constituted a very short forewarning compared to the longer forewarning in Abilene. In each community, the size of the community segment affected was similar. It should be noted, however, that a propane gas threat was a very unfamiliar threat for citizens in Mt. Vernon; the most common threat to the community was seasonal flooding.

In each community a probability sample of warning recipients was drawn. This was accomplished by mapping the area authorities indicated had been warned and using a Polk's City Directory to enumerate all

residential addresses within the target space. Personal interviews were conducted with completion rates of 92.3 percent in Abilene (n = 185) and 90.4 percent in Mt. Vernon (n = 147). In each community, respondents who claimed that they did not receive a pre-impact warning were removed from the analysis, yielding 182 cases in Abilene and 123 cases in Mt. Vernon.

ANALYSIS AND DISCUSSION

Table 1 shows the zero-order product moment correlation coefficients between each independent variable and evacuation compliance. With one exception, these correlations support the relationships hypothesized in the five propositions comprising our model. In particular, perceived risk, warning content specificity, source credibility and warning confirmation are all positively correlated with evacuation compliance in each disaster event. The presence of an adaptive plan is positively correlated with compliance in the flood setting (Abilene), but the correlation is very low in Mt. Vernon and not statistically significant. In both communities, the correlation between ethnic group membership (black and Mexican-American) is of low magnitude and not statistically significant as we predicted based on our theoretical framework. Income is correlated with ethnicity in Mt. Vernon (r = -.36) and Abilene (Blacks r = -.20; Mexican-Americans r = -.39) as we anticipated; minority citizens show lower family incomes than Anglo citizens. As we also predicted, however, the zero order correlation between income and compliance approaches zero in both communities. We will further explore and explain the relationships in the model using ordinary least squares regression analysis.

Table 1
Zero Order Correlations (Pearson's r)
with Evacuation Compliance by Community

	Mt. Vernon[a]	Abilene
Perceived Risk	.57*	.70*
Adaptive Plan	.01	.35*
Content	.40*	.28*
Credibility	.51*	.46*
Confirmation	.36*	.58*
Mexican American	-.20	-.02
Black	—	.15
Income	-.07	.06

Table 2 shows the standardized partial regression coefficients and the squared multiple correlation coefficient for each data set. The multiple correlation coefficient (R^2) is a measure of the goodness of fit of the data to the model. Put another way, this statistic tells us how much variance in the dependent variable is explained by all of the independent variables acting simultaneously. The overall fit is good in both of our communities. In Mt. Vernon, the independent variables explained 58 percent ($p<.05$) of the variance in evacuation compliance. In Abilene, the model explained 67 percent ($p<.05$) of the variance in compliance behavior.

Table 2
Standardized Partial Regression Coefficients by Community

	Mt. Vernon[a] Beta	Abilene Beta
Credibility	.30*	.15*
Adaptive Plan	.12	.10*
Perceived Risk	.46*	.48*
Confirmation	.19*	.35*
Content	.17*	.05
Mexican American	.13	.01
Black	—	.06
Income	.04	.03
R^2	.58	.67
F ratio	22.81*	44.32*

* $p<.05$
[a] There were no blacks in the Mt. Vernon sample.

Regression analysis also affords a basis for ranking the independent variable relative to their importance in explaining variance in the dependent variable. This is accomplished by examining the standardized partial regression coefficients, usually called betas. While beta coefficients are not a measure of explained variance, one can compare their relative magnitudes to rank order the independent variables (Berry and Feldman 1985).

With respect to the Mt. Vernon data, the betas indicate that perceived risk has the greatest importance, followed by source credibility, warning confirmation and warning content. In Mt. Vernon, ethnic status as a Mexican-American and possession of an adaptive plan do not show statistically significant beta coefficients and rank as the least important of the constellation of variables. With respect to ethnicity, this result was expected in the

sense that it could be derived from our theoretical framework. We anticipated no effect for ethnicity and income evacuation compliance, and found none. We did predict that possession of an adaptive plan should increase the likelihood of compliance and found that not to be the case in Mt. Vernon. It can be suggested that having a plan might be less important for Mt. Vernon residents for two related reasons. First, accomplishing an evacuation in this case was not complicated in that virtually everywhere outside the warned area was safe and the derailment as a threat left all roads open, passable and unaffected by weather. Second, there was time pressure for warning recipients to depart. Under these conditions, prior planning can be argued to be of diminished importance in the decision to evacuate.

The betas for the Abilene flood also show that ethnicity (either being black or Mexican-American) and income has no statistically significant impact on evacuation compliance. In these data, perceived risk is the most important independent variable, followed by warning confirmation, source credibility and adaptive planning. Contrary to our theoretical prediction, specificity of warning content did not produce a statistically significant beta.

It is important that in both disaster events, the same variable—perceived risk—generated the highest beta coefficient. Thus, risk as a determinant of compliance performs equally well whether the disaster event has brief or long forewarning, whether the event is familiar or not, and whether the character of the agent is technological or natural.

When we consider the rank order of the statistically significant variables within each model, some interesting observations can be made. Source credibility and warning confirmation are the second and third most important variables in each data set. In the derailment, source credibility precedes confirmation in importance. This suggests that in a situation with short forewarning (where citizens must act quickly) of an unfamiliar threat source credibility takes on greater significance than confirmation, for which limited time is available anyway. On the other hand, in a slow developing event that is familiar to warning recipients, there is time for an extended confirmation process possibly involving a ranges of sources. In this setting, the credibility of any single source is balanced by the variety of sources contacted and familiarity with the event means that citizens need not look to a credible source for defining the nature of danger.

Warning content shows a statistically significant beta in Mt. Vernon but not in Abilene, while adaptive plan is significant in Abilene but not Mt.

Vernon. We have already suggested that the low importance of an adaptive plan in Mt. Vernon may be a function of the relatively straightforward nature of the evacuation problem at that site. In most cases, evacuation is not a complicated protective action, and accomplishing a minimally effective evacuation (clearing an area) requires little planning. Of course, effectiveness is greatly enhanced when a warning recipient knows appropriate routes, safe destinations, takes important personal papers and medicines, and so on. But minimal performance can be achieved with minimal planning. Evacuation becomes more complicated, however, when route or destination information, in particular, is not clear or obvious. In Abilene the complication was related to routes of egress. Although flooding was a familiar threat, multiple flood areas from multiple creeks was less common and raised the issue of which routes were safe (unaffected by the flooding). In this case, citizens with an adaptive plan would be more likely to be aware of multiple alternate evacuation routes, thereby increasing the importance of having a plan for evacuation compliance.

In terms of the emergent norm framework, the importance of the of warning content stems from the idea that information can be provided that pertains to risk (i.e., the nature of the threat and information on location of impact) and that addresses risk reduction (possible protective actions). As operationalized here, a more specific message provides more relevant information. The finding that content specificity was statistically significant in Mt. Vernon but not so in Abilene can be addressed in terms of differences between the sites in perceived time before impact and in terms of differences in threat familiarity.

In part, what we have found is that in longer forewarning, high familiarity threats, warning content is less important in evacuation compliance. When citizens are familiar with the threat and perceive response time to be ample, the message that a flood is imminent and one should evacuate presents no startling revelation. We have already found that under long forewarning-high familiarity conditions, warning confirmation behavior is emphasized. In these situations, the warning appears to be viewed as an event that provides a cue to initiate information gathering through the confirmation process, rather than as a principal information source in itself.

To summarize our analysis of the evacuation compliance model, several points can be made. First, the overall model explains compliance well in each community: the R^2 indicates that nearly 60 percent of the variance is

explained in Mt. Vernon and nearly 70 percent in Abilene. Perceived risk is a preeminent factor in compliance in both communities. Variations in the relative importance of the other independent variables are explainable in terms of typologically derived dimensions—event familiarity, time between warning and response, physical-geographical characteristics of impact—that were different for each site. It is important to note that we did not need to use phenotypic differences—e.g., natural versus technological nature of impact agent—to understand compliance behavior. Finally, ethnic group membership was not a significant factor in explaining evacuation compliance. Thus, within the theoretical logic derived from the emergent norm approach and in terms of the independent variables included in the model, ethnicity showed no direct affect on evacuation compliance. It is important to emphasize that this is not to say that ethnicity has no impact on warning behavior generally. Indeed, it is quite likely that this more general claim is not true.

ETHNIC DIFFERENCES

To demonstrate where ethnic group differences are likely to lie, we will focus on the variables included in the evacuation compliance model. In particular, there is reason to believe that there are ethnic variations in defining which sources are credible and in the process or approach that one takes to warning confirmation. Table 3 shows highest confidence source and first source contacted for confirmation by ethnic group membership and community. The Abilene data show that in connection with a familiar, slow developing threat, most whites (57.3%) placed highest confidence in mass media, with authorities (police and/or fire personnel) a distant second choice. Blacks placed highest confidence in authorities (51.6%), with social network contacts (friends and relatives) a much closer second choice. On the other hand, the majority of Mexican-Americans (63.2%), with authorities and mass media tied for very distant second choice. In general these data indicate that minorities are much more likely than whites to cite social network contacts as the source in which they place highest confidence. Minority citizens are somewhat more likely (especially blacks) to choose authorities as the highest confidence source. Whites, on the other hand, are much more likely than minorities to select mass media as the source of highest confidence.

When we move to Mt. Vernon, where the threat was unfamiliar and time to act was short, a slightly different pattern emerges. In this case the largest proportion of Mexican-Americans (41.6%) and whites (67.7%) identified an authority as the most credible source. The second choice among the largest proportion of whites was a social network contact (19.5%), while Mexican-Americans choose mass media (30.6%).

Table 3
Highest Confidence Source and Source Initially Contacted for Confirmation by Ethnicity and Community

	Abilene						Mt. Vernon			
	Black		White		Mexican-American		White		Mexican-American	
Highest Confidence	N	%	N	%	N	%	N	%	N	%
Police/Fire	33	51.6	14	17.1	7	18.4	59	67.7	15	41.6
Mass Media	3	4.7	47	57.3	7	18.4	10	11.5	11	30.6
Friend/ Relative	19	29.6	10	12.2	24	63.2	17	19.5	8	22.3
Personal Judgment	9	14.1	11	13.4	0	0.0	1	1.1	2	5.6
First Source Contacted										
No attempt	17	26.5	13	15.8	3	7.9	28	32.2	1	2.8
Police/Fire	7	11.0	2	2.5	0	0.0	16	18.3	3	8.4
Mass Media	6	9.4	36	43.9	22	57.9	23	26.4	14	38.9
Friends/ Relatives	34	53.1	31	37.8	13	34.2	20	22.9	18	50.0

Sorting out the different patterns is difficult since we are dealing with differences in ethnicity, lead time and threat agent familiarity and these are confounded with site. It seems clear that most citizens, regardless of ethnicity, identify authorities as the most credible source when the threat agent is unfamiliar and lead time is short. Furthermore, in familiar threats with ample lead time, social networks are identified as having higher credibility by minority citizens (particularly Mexican-Americans). Minorities (particularly blacks) seem more likely than whites to identify authorities as a credible source, except when the threat agent is unfamiliar (in which case most minority and majority citizens chose authorities as the most credible source). In familiar threats, whites relied on mass media as a credible source more than minority citizens.

The warning confirmation process represents another place where one would expect to find ethnic differences. The bottom of Table 3 shows the

first source that citizens attempted to contact for confirmation by ethnicity and community. An important first point deals with the extent to which confirmation is engaged in at all. In the Abilene data, more than 90 percent of the Mexican-Americans made some attempt to confirm the warning, approximately 75 percent of the blacks did so and about 85 percent of the whites. In Mt. Vernon, more than 95 percent of the Mexican-Americans compared with less than 70 percent of the whites attempted confirmation. Thus in both sites, a greater proportion of Mexican-Americans attempted some confirmation and the blacks in Abilene were roughly comparable to whites. Interestingly, among those citizens who did try to confirm warnings, minorities made many more contacts in the confirmation process than did whites. In Abilene 35 of 48 blacks (72.9%) who attempted to confirm did so with three or more sources. Twenty-three of 35 Mexican-Americans (65.7%) used three or more confirmation sources, while only 31 of 69 whites (44.9%) used three or more sources. Similarly, in Mt. Vernon 16 of 35 Mexican-Americans (45.7%) used three or more sources compared with 19 of 60 whites (31.5%). These data show that without regard to the nature of the threat, minorities who undertake warning confirmation contact a greater number of sources in the process than do whites.

Turning to the remainder of Table 3, we see that the largest proportion of Abilene blacks (53.1%) sought confirmation first from social networks; authorities and mass media were selected for first contact by similar, but much smaller, proportions of respondents. The greatest proportion of whites (43.9%) chose mass media for first contact, followed by social networks (37.8%). Mexican-Americans showed the same pattern as whites, with the greatest proportion contacting mass media first (57.9%), followed by social networks (34.2%). In Mt. Vernon, the greatest proportion of whites first contacted mass media (26.4%), followed by social networks (22.9%). The pattern for Mexican-Americans is reversed in these data: 50.0 percent contacted social networks and 38.9 percent contacted mass media first. Again, conclusions should be treated cautiously due to the confounding of ethnicity, forewarning, and event familiarity with site. It appears that whites are most likely to seek initial confirmation with mass media (followed by social networks) without regard to characteristics of the threat. It does appear that whites are slightly more likely to use social networks first in a slow developing, familiar threat than in a fast developing, unfamiliar threat. Blacks seem to rely most heavily on social networks, although there is no

data on black choices in the fast developing, unfamiliar threat. Mexican-Americans rely on the same two sources as whites for the most part, but seem to rely on media more often in slow developing threats and social networks more in fast developing threats.

It is important to note that the purpose of this paper was to develop a model of evacuation compliance behavior and test it for ethnicity effects. Our closing discussion of ethnic differences goes beyond the model itself and was included to document that ethnic variations do exist on variables related to evacuation compliance. It remains, however, that evacuation compliance conceived in the terms of our model is not in itself affected directly by ethnicity. It should be remembered, however, that only two minority groups were examined—blacks and Mexican-Americans—and that other minority groups need to be examined as well. In closing it is also important to remember that ethnic differences are probably present in a wide variety of disaster activities—not just warning response but across the range of mitigation, preparedness, response and recovery behaviors. An important part of disaster research in the coming decade will be to identify and begin the process of explaining differences in disaster behavior among different ethnic groups.

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